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QUALCOMM INCORPORATED
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EXAMINER	
WONG, LINDA	
ART UNIT	PAPER NUMBER
2611	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/821,390	WALLACE ET AL.	
	Examiner	Art Unit	
	LINDA WONG	2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 June 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-52* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-52* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Response to Arguments

1. Applicant's arguments, see Applicant's Arguments, filed 6/11/208, with respect to the rejection(s) of claim(s) 1-50 under Khayrallah have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Sadowsky (US Publication No.: 20050220199).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

1. **Claims 1-3,5-6,10,12,15,17,19,21,24-25,29,32-33,35-36,40-42,45-52** are rejected under 35 U.S.C. 102(e) as being anticipated by Sadowsky (US Publication No.: 20050220199).

   a. **Claims 1,17**,

      i. Sadowsky et al discloses

         - "obtaining a base matrix" (paragraph 22 discloses V* is a fixed unitary matrix.)

- "selecting at least one different combination of scalars, each combination including at least one scalar for at least one row of the base matrix, one scalar per row, each scalar being a real or complex value" (Paragraph 22 discloses the equation used to compute the modified steering matrix, wherein the scalar matrix is equivalent to $D(f;\tau)$ and the base matrix, V^*. The equation indicates the two matrices' are multiplied. Based on the laws of multiplying matrices', one scalar or one column of the scalar matrix would be matched to a row of the base matrix. The matrix $D(f;\tau)$ is shown to have different phases and such phase are produced from real and imaginary parts. The scalars are selected based on the subcarrier frequency as described in paragraph 22.) and
- "forming at least one steering matrix by multiplying the base matrix with the at least one different combination of scalars, wherein one steering matrix is formed by each combination of scalars". (Paragraph 22 discloses the equation used to compute the modified steering matrix.)

b. **Claim 2**, Sadowsky et al discloses "forming a plurality of steering vectors with columns of the at least one steering matrix". (Paragraph 22 discloses the equation used to compute the modified steering matrix.)

c. **Claims 3,5,14,18,27,37**, Sadowsky et al discloses "the base matrix is a unitary matrix having orthogonal columns." (paragraph 22 discloses "the steering

matrix V* may be "any fixed unitary matrix; for example, the Walsh matrix previously displayed.")

d. **Claims 6,15,19,29,** Sadowsky et al discloses "each of the at least one steering matrix has orthogonal columns". (Abstract discloses an OFDM system wherein the steering matrix would be produced to have orthogonal elements.)

e. **Claim 7**, Sadowsky disclsoes "scalars for the atl east one different combination are selected from a set comprising +1,-1.+j and –j. where j is a square root of -1". (paragraph 22 shows the phases or elements within the scaling matrix. The phase can be express in the forms of real and imaginary through known mathematical techniques. Such values would be as indicated in the limitations.)

f. **Claim 8,16,20,30,38**, Sadowsky et al discloses "each element of the at least one steering matrix belongs in a set comprising +1, -1, +j and –j, where j is the square root of -1". (paragraph 22 shows the production of the modified steering matrix, wherein the scalar matrix can be mathematically show to be equivalent to the values indicated above. (see claim 7.) We know V* is an identity matrix or Walsh matrix or unitary matrix, the values multiplied with such a matrix would place the elements within such a set as described above.)

g. **Claim 9,31**, Sadowsky et al discloses "each of the at least one steering matrix includes elements having equal magnitude." (paragraph 22 shows the matrix steering vector, wherein the production of the elements of the steering matrix, V* and scalar vector would produce elements of equal magnitude given the values of the scalar vector.)

h. **Claim 10**, Sadowsky et al discloses "the base matrix has a dimension of N by N, where N is an integer greater than one, and wherein each combination includes N - 1 scalars for N - 1 rows of the base matrix". (Paragraphs 22-24 disclose the number of rows of the steering vector is the number of antennas and the number of columns of the steering vector is the number of spatial streams. Depending on the number of streams and antennas, the values can have N-1 scalars for N-1 rows of the base matrix.)

i. **Claim 12**, Sadowsky et al discloses "the at least one combination of scalars is obtained with a base-K counter having one digit for each of the at least one scalar in a combination, where K is the number of different possible scalars usable for each row of the base matrix". (Paragraph 22 shows the K number of different possible scalars, wherein a counter or indicator would be used within a software or firmware implementation of the invention would be used to indicate when the end of the matrix is. (paragraph 28 discloses implementation of the invention can be performed in firmware and software.))

j. **Claim 21** inherits all the limitations of claim 1, but claim 1 fails to recite "processing data to obtain a block of data symbols to be transmitted in a plurality of transmission spans" and "performing spatial processing on at least one data symbol to be transmitted in each transmission span with the steering matrix obtained for the transmission span, the spatial processing resulting in the block of data symbols observing a plurality of effective channels formed with the plurality of steering matrices." (Fig. 5, label 86 and 88 shows spatial processing

on a block of data symbols for transmission (label 96) and steering matrix processing on the block of data symbols. Paragraphs 22-24 describes the steering matrix.)

k. **Claim 24**, Sadowsky et al discloses "the plurality of transmission spans correspond to a plurality of time intervals." (paragraph 17 discloses "the signal transmitted from the Mth transmit antenna is cyclically delayed by (M-1)D time samples with respsect to the first antenna, where D is the delay." This indicates the transmission spans corresponding to time intervals.)

l. **Claims 25,35,40**, Sadowsky et al discloses "each steering matrix has one column, and wherein one data symbol is transmitted in each transmission span." (paragraph 22-24 discloses the steering matrix. Fig. 5 shows the modified data symbol is transmitted through different antennas, wherein each antenna would have its own transmission span.)

m. **Claims 26,36,41**, Sadowsky et al discloses "each steering matrix has multiple columns, and wherein multiple data symbols are transmitted simultaneously in each transmission span". (Fig. 5 shows the modified data symbol is transmitted through different antennas, wherein each antenna would have its own transmission span.)

n. **Claims 34,39** inherit all the limitations of claim 21.

o. **Claims 32,33**, Sadowsky et al discloses "the plurality of steering matrices' are unknown to a receiving entity for the block of data symbols" and "known only to the transmitting entity." (Fig. 5 shows a transmitter, wherein the transmitter

does not have a connection to a connecting receiver for sending the steering matrices' used to produce the data transmitted. Thus, the receiving entity would receive the data without knowing the steering matrices' used.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. **Claim 4** is rejected under 35 U.S.C 103(a) as being unpatentable over Sadowsky et al as applied to claim 1 in view of Craw (NPL: “The Fourier Matrix”).
   a. **Claim 4,28**, Sadowsky fails to disclose "the base matrix is a Fourier matrix." Sadowsky discloses the base matrix can be any unitary matrix, Wherein Fourier matrix is a type of unitary matrix. (See reference The Fourier Matrix.) Thus, it would have been obvious to one skilled in the art to use a Fourier matrix, since the base matrix must be any unitary matrix.

3. **Claims 11,13** are rejected under 35 U.S.C. 103(a) as being unpatentable over Sadowsky et al as applied to claim 1.
   a. **Claim 11**, Sadowsky et al discloses “N is a power of two”. (Col. 5, lines 32-40 discloses N >= M.) It would be obvious to one skilled in the art for N to be a

power of two depends on the number of antennas as well as the inventors design choice.

b. **Claim 13** inherits all the limitations of claim 1, but claim 1 fails to recite the limitation "a memory operative to store the base matrix, or at least one steering matrix, or both the base matrix and the at least one steering matrix". Sadowsky et al discloses a digital signal processor or general purpose microprocessor, wherein memory is common in a processor. (paragraph 28) It would have been obvious to one skilled in the art at the time of the invention to incorporate a memory block to store the base matrix and/or steering matrix within the processor as disclosed by Sadowsky et al so to allow for easy access to the information.

4. **Claims 22-23** are rejected under 35 U.S.C 103(a) as being unpatentable over Sadowsky et al as applied to claim 21 in view of Khatri (US Patent No.: 7020490).

a. **Claim 22,**

i. Sadowsky et al fails to disclose "the multi-antenna communication system utilizes orthogonal frequency division multiplexing (OFDM), and wherein the plurality of transmission spans correspond to a plurality of subbands."

ii. Khatri discloses such limitations. (Col. 4, lines 53-56) It would have been obvious to one skilled in the to transmit using OFDM as disclosed by Khatri, wherein transmission signals are produced using orthogonal scaling as

disclosed by Sadowsky et al so to provide independent phase and amplitude to avoid co-channel interference.

b. **Claim 23,**

i. Sadowsky et al fails to disclose "multi-antenna communication system utilizes orthogonal frequency division multiplexing (OFDM), and wherein each of the plurality of transmission spans corresponds to one or more subbands in one time interval."

ii. Khatri discloses such limitations. (Col. 4, lines 53-56 discloses sending information using different sub-bands and different carrier frequencies, wherein such sub-bands and carrier frequencies can be more than 1.) It would have been obvious to one skilled in the to transmit using OFDM as disclosed by Khatri, wherein transmission signals are produced using orthogonal scaling as disclosed by Sadowsky et al so to provide independent phase and amplitude to avoid co-channel interference.

5. **Claims 42-,45-52** are rejected under 35 U.S.C. 103(a) as being unpatentable over Sadowsky et al (US Publication No.: 20050220199) in view of Khayrallah et al (US Patent No.: 6711124).

a. **Claim 42** inherits all the limitations of claim 1 or 21, but claim 1 fails to recite the limitations "deriving a plurality of spatial filter matrices based on a channel response estimate and a plurality of steering matrices", "obtaining, in the plurality of transmission spans, R sequences of received symbols via R receive

antennas, where R is an integer one or greater" and "performing receiver spatial processing on the R sequences of received symbols with the plurality of spatial filter matrices to obtain detected symbols".

b. **Sadowsky fails to disclose such limitations.**

c. Khayrallah et al discloses in Fig. 6 a receiver uses the channel estimate for equalization, wherein the channel estimates are produced based on the training sequences. (Col. 1, lines 29-42) The training sequences are produced using the scaling matrix as shown in Fig. 3. Fig. 4 shows a plurality of antennas, wherein the plurality of antennas would receive one or more sequences since each antenna would receive information. It would have been obvious to one skilled in the art at the time of the invention to incorporate the use of a channel equalizer as disclosed by Khayrallah et al into Sadowsky so to eliminate interference within the signal after transmission by filter or equalizing.

d. **Claims 45 and 46**, Khayrallah et al discloses "each steering matrix has one column, and wherein each spatial filter matrix has a dimension of one by one" and "each steering matrix has N columns and each spatial filter matrix has a dimension of N by R, where N and R are integers greater than 2. (Fig. 6 shows the receiver performing channel estimation and equalization. Fig. 7 shows the calculation of the channel estimation. Col. 7, line 58-Col.8, line 18 discloses the channel estimates are determined based on the scaling value matrix elements from the column corresponding to the antenna. Given the scaling value matrix is one by one, then the channel estimates would be a one by one matrix. Given

the scaling value matrix is N by R, wherein N and R are integers greater than 2, the channel estimate would be a N x R matrix.)

e. **Claims 47 and 50** inherits all the limitations of claim 42.

f. **Claims 48-49 and 51-52** inherits all the limitations of claims 45 and 46.

6. **Claims 43-44** are rejected under 35 U.S.C 103(a) as being unpatentable over Sadowsky et al in view of Khayrallah et al as applied to claim 42 in view of Khatri (US Patent No.: 7020490).

a. **Claim 43,**

i. Sadowsky et al fails to disclose "the multi-antenna communication system utilizes orthogonal frequency division multiplexing (OFDM), and wherein the plurality of transmission spans correspond to a plurality of subbands."

ii. Khatri discloses such limitations. (Col. 4, lines 53-56) It would have been obvious to one skilled in the to transmit using OFDM as disclosed by Khatri, wherein transmission signals are produced using orthogonal scaling as disclosed by Sadowsky et al so to provide independent phase and amplitude to avoid co-channel interference.

b. **Claim 44,**

i. Sadowsky et al fails to disclose "multi-antenna communication system utilizes orthogonal frequency division multiplexing (OFDM), and wherein each of the plurality of transmission spans corresponds to one or more subbands in one time interval."

ii. Khatri discloses such limitations. (Col. 4, lines 53-56 discloses sending information using different sub-bands and different carrier frequencies, wherein such sub-bands and carrier frequencies can be more than 1.) It would have been obvious to one skilled in the to transmit using OFDM as disclosed by Khatri, wherein transmission signals are produced using orthogonal scaling as disclosed by Sadowsky et al so to provide independent phase and amplitude to avoid co-channel interference.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LINDA WONG whose telephone number is (571)272-6044. The examiner can normally be reached on 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Payne can be reached on (571) 272-3024. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Linda Wong
9/29/2008

/Kevin M. Burd/
Primary Examiner, Art Unit 2611